Claims

1. A spectrometer, comprising:

a light source for illuminating tissue; and

a plurality of light detectors for detecting optical properties of the illuminated tissue, the plurality of light detectors adapted for converting optical signals to electrical signals, the light source and the plurality of light detectors adapted for placement together within a body.

2. The spectrometer of claim 1 further comprising a lens disposed in a pathway of light generated by the light source for focusing or diffusing the light.

3. The spectrometer of claim 1 further comprising a frequency multiplier disposed in a pathway of light generated by the light source for amplifying frequency of the light emission.

4. The spectrometer of claim 1 further comprising a filter disposed in a pathway of light generated by the light source for illuminating tissue with light having a predetermined wavelength.

5. The spectrometer of claim 1 wherein the light source and the plurality of light detectors are sized to provide a miniature spectrometer, wherein a dimension of the spectrometer in any direction is less than about 3 mm.

6. The spectrometer of claim 1 wherein the plurality of light detectors detect light emission at multiple wavelengths.

7. The spectrometer of claim 1 wherein at least one detector of the plurality of light detectors is adapted for monitoring light emission from the light source.

8. The spectrometer of claim 1 further comprising at least one filter disposed adjacent a detector of the plurality of light detectors for selectively detecting light emission having a pre-determined wavelength.

9. The spectrometer of claim 1 wherein the light source and the plurality of light detectors are formed on a single substrate.

10. The spectrometer of claim 9 wherein the light source is a light emitting diode and the plurality of light detectors is a photodiode comprising a plurality of channels.

11. The spectrometer of claim 1 further comprising a housing encapsulating the light source and the plurality of light detectors.

12. The spectrometer of claim 11 wherein the housing is substantially transparent.

13. The spectrometer of claim 11 wherein the housing is adapted for directing or diffusing light generated by the light source.

14. The spectrometer of claim 1 further comprising an interventional device adapted to place the light source and the plurality of light detectors within a body.

15. The spectrometer of claim 14 wherein the light source and the plurality of light detectors are encapsulated in a housing and the housing is adapted for attachment to a distal end of the interventional device.

16. The spectrometer of claim 14 wherein the interventional device is selected from a group consisting of catheter, guidewire, needle, endoscope, implant, and trocar.

17. The spectrometer of claim 14 further comprising an optically transparent tip encapsulating the light source and the plurality of detectors disposed at a distal end of the

interventional device, wherein the tip is shaped for optimizing tissue contact and optical transmission.

18. The spectrometer of claim 14 wherein the light source and the plurality of light detectors are disposed inside the interventional device.

19. The spectrometer of claim 17 wherein a surface of the tip is coated with a material for improving light transmission.

20. The spectrometer of claim 17 wherein the tip comprises at least one fluid channel in communication with a lumen in the interventional device for delivering a fluid necessary for a monitoring procedure.

21. The spectrometer of claim 17 wherein the tip comprises at least one filter and the light source is adapted to be rotated with respect to the tip, thereby adjusting an optical property of the light generated by the light source.

22. The spectrometer of claim 1 further comprising an external power source in electrical communication with the light source and the plurality of light detectors.

23. A spectrometer module comprising a plurality of light detectors for detecting optical properties of tissue, wherein each detector comprises multiple channels for detecting light emission having multiple wavelengths, is capable of converting optical signals to electrical signals, and is sufficiently small to allow the module to be placed within a body.

24. A method for characterizing tissue comprising:

providing a spectrometer comprising a light source and a plurality of light detectors adapted for converting optical signals to electrical signals;

placing the spectrometer inside a body near tissue to be characterized;

connecting the light source and the plurality of light detectors to a power source;

illuminating the tissue; and

measuring optical properties of the illuminated tissue.

25. The method of claim 24 further comprising monitoring light emission from the light source.

26. The method of claim 24 wherein providing a spectrometer comprises providing a module having the light source and the plurality of light detectors formed on a single substrate.

27. The method of claim 24 further comprising providing an interventional device, disposing the spectrometer near a distal end of the interventional device and inserting the interventional device inside the body.

28. The method of claim 26 wherein the spectrometer is encapsulated by an optically transparent tip disposed near the distal end of the interventional device and further comprising rotating the module with respect to the tip, thereby adjusting optical property of the light generated by the light source.

29. The method of claim 26 wherein the spectrometer is encapsulated by an optically transparent tip comprising at least one fluid channel in communication with a lumen in the probe and delivering a fluid necessary for a monitoring procedure to the illuminated tissue.

30. The method of claim 24 wherein the plurality of light detectors comprises a light detector having a plurality of channels and measuring optical properties comprises detecting light emission at multiple wavelengths.

31. The method of claim 24 wherein illuminating the tissue comprises generating light from the light source and focusing the generated light on the tissue to be illuminated with a lens disposed in a pathway of the generated light.

32. The method of claim 24 wherein illuminating the tissue comprises generating light from the light source and diffusing the generated light with a lens disposed in a pathway of the generated light to illuminate the tissue.

33. The method of claim 24 wherein illuminating the tissue comprises generating light from the light source, amplifying the generated light by passing the light through an optically nonlinear substance disposed in a pathway of the generated light and illuminating the tissue with the light.

34. A method for characterizing tissue comprising:

placing a spectrometer comprising a plurality of light detectors inside a body near tissue to be characterized, wherein the at least one light detector converts optical signals to electrical signals;

connecting the plurality of light detectors to a power source;

illuminating the tissue; and

measuring optical properties of the illuminated tissue.

35. A spectrometer, comprising:

a source of ultraviolet (UV) light for illuminating tissue; and

at least one light detector for detecting UV light emissions from the illuminated tissue, the at least one light detector adapted for converting UV light emissions into electrical signals, the light source and the at least one light detector adapted for placement together within a body.

36. The spectrometer of claim 35 further comprising at least one filter disposed adjacent the at least one detector for selectively detecting UV light emission within a predetermined wavelength band.

37. The spectrometer of claim 36 wherein the at least one filter is a bandpass filter with a passband centered at a wavelength of 380 nm.

38. The spectrometer of claim 36 wherein the at least one filter is a bandpass filter with a passband centered at a wavelength of 440 nm.